

# Greenhouse gas emissions of local wood energy from northeastern US forests



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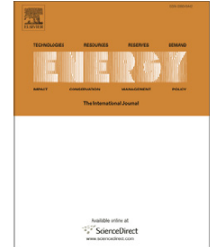
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# Greenhouse gas emissions of local wood pellet heat from northeastern US forests



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# The Key: Baseline assumptions

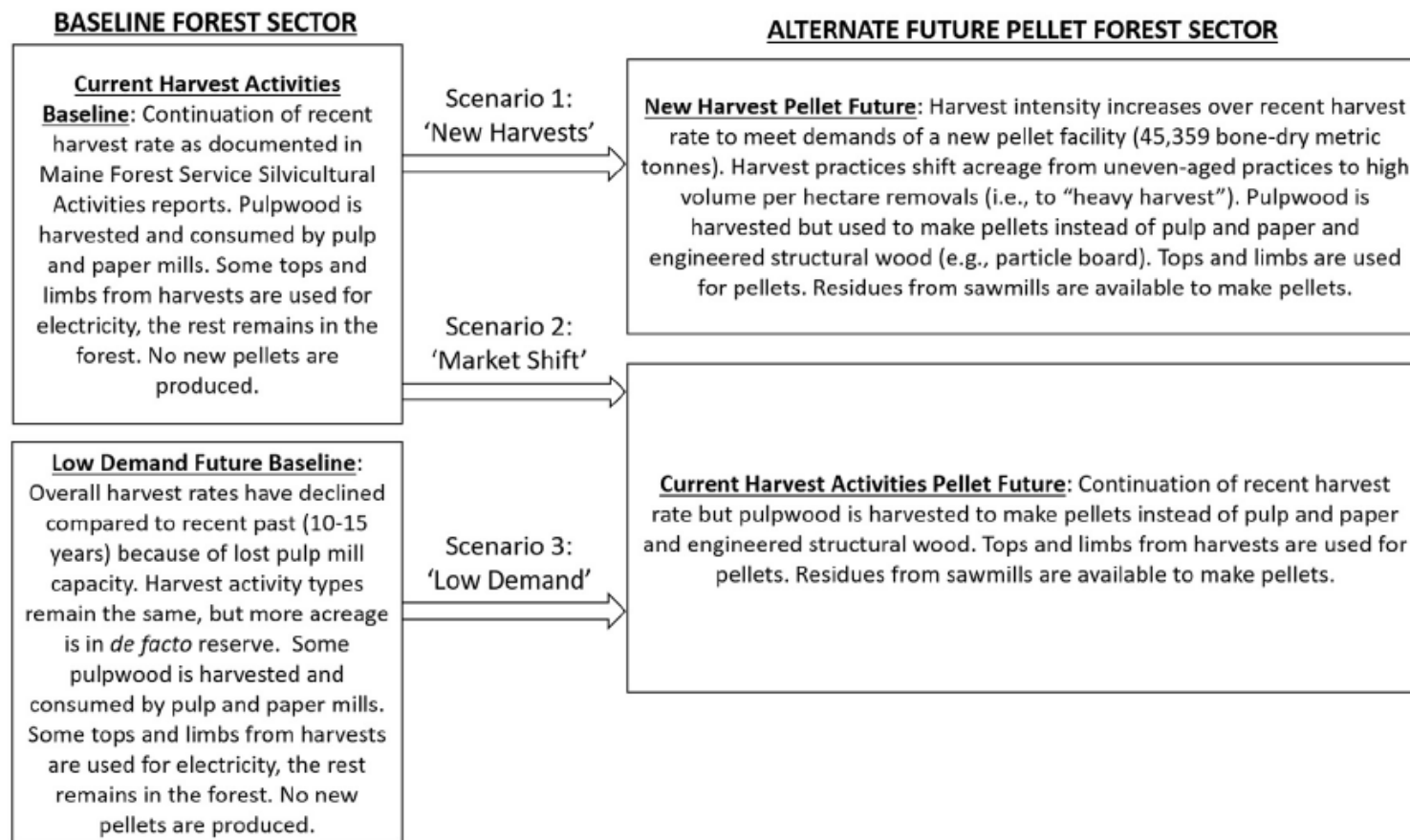
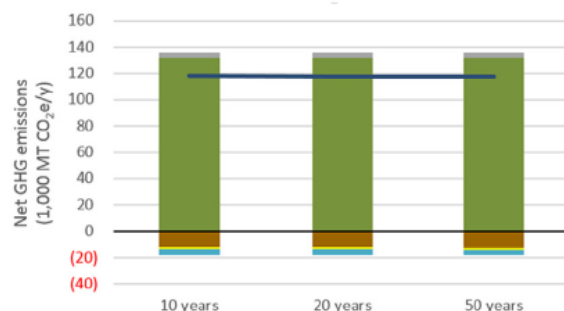


Fig. 1. Forest sector market comparison pathways.

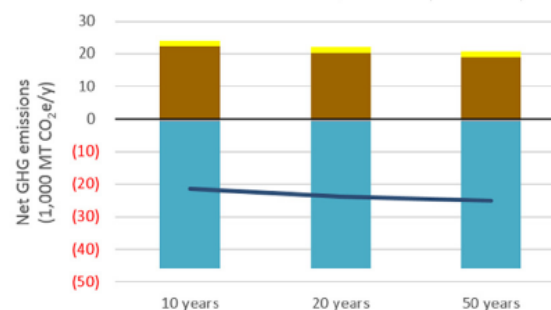
# Forest product carbon pools



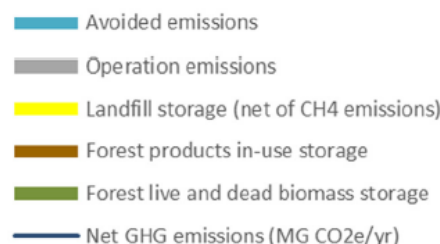
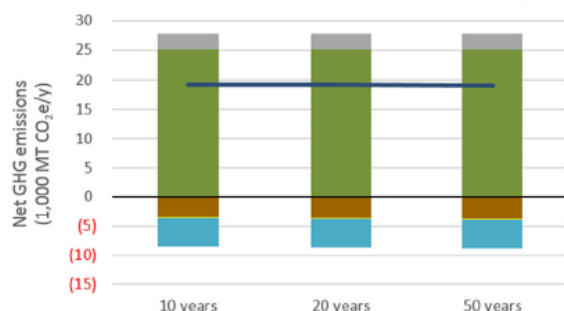
**a) Scenario 1: 'New Harvests';**  
100% pulpwood



**b) Scenario 2 'Market shift';**  
50%/50% pulpwood sawmill residue mix



**c) Scenario 3: 'Low demand';**  
100% pulpwood



**Fig. 2.** Net GHG emissions across a representative wood supply area in the northeastern US by carbon accounting category and timescale with example feedstock mixes for each economic scenario. All scenarios assume that 50% of the feedstock is derived from sawmill residues while the remaining 50% are sourced from forest operations. Pellets from new harvests in addition to current harvest activities (Figure 2a) as well as pellets derived from harvests that would have not been executed due to the closing of pulp mills (Figure 2c) result in a net GHG increase mostly driven by net GHG emissions occurring in forest carbon pools (green). Pellets derived from harvests that would have occurred anyway to supply (now closed) pulp mills (Figure 2b) result in a net GHG decrease mostly driven by reduced avoided fossil fuel emissions from both pulp manufacturing and fossil-fuel based heat. See Fig. 1 for an explanation on the three forest sector market scenarios. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)



# Sourcing of biomass



**Table 3**

GHG emissions by economic scenario and timescale when displacing home heating oil with regionally sourced wood pellets in the Northern Forest. Net GHG emissions (MT CO<sub>2</sub>e/y) are across the wood supply area and inclusive of upstream and downstream forest sector emissions. Green and red shading indicate positive and negative climate benefits, respectively. Plant size was scaled for 45,359 MT of annual pellet production and partly limited by scenario-specific wood supply area forest growth limits.

Scenario Title	Feedstock			Pellet Net GHG emissions										Results Category
	0%	Source	100%	MT CO <sub>2</sub> e/Y			% Change			MT CO <sub>2</sub> e/MT Pellets				
	Pulpwood	Sawmill Residues		10 y	20 y	50 y	10 y	20 y	50 y	10 y	20 y	50 y		
1 'New harvests'				27,240	29,886	31,474	3%	4%	4%	0.6	0.7	0.7	Climate Neutral	
1 'New harvests'				57,361	59,030	60,032	7%	8%	8%	1.3	1.4	1.4	Climate Negative	
1 'New harvests'				87,553	88,245	88,660	11%	11%	12%	2.1	2.1	2.1	Climate Negative	
1 'New harvests'				117,813	117,527	117,356	15%	15%	15%	2.8	2.8	2.8	Climate Negative	
2 'Market shift'	Harvest Residues			20,665	2,231	-21,292	2%	0%	-3%	0.5	0.0	-0.5	Climate Neutral	
2 'Market shift'				-85,185	-85,185	-85,185	-11%	-11%	-11%	-1.9	-1.9	-1.9	Climate Beneficial	
2 'Market shift'				-53,411	-54,452	-55,077	-7%	-7%	-7%	-1.2	-1.2	-1.2	Climate Beneficial	
2 'Market shift'				-21,558	-23,640	-24,889	-3%	-3%	-3%	-0.5	-0.5	-0.5	Climate Neutral	
2 'Market shift'				10,376	7,253	5,379	1%	1%	1%	0.2	0.2	0.1	Climate Neutral	
2 'Market shift'				42,388	38,224	35,725	5%	5%	5%	0.9	0.8	0.8	Climate Negative	
3 'Low demand'				-76,441	-73,437	-71,635	-10%	-9%	-9%	-1.7	-1.6	-1.6	Climate Beneficial	
3 'Low demand'				-44,604	-42,641	-41,463	-6%	-5%	-5%	-1.0	-0.9	-0.9	Climate Beneficial	
3 'Low demand'				-12,674	-11,752	-11,199	-2%	-2%	-1%	-0.3	-0.3	-0.2	Climate Neutral	
3 'Low demand'				19,343	19,224	19,153	2%	2%	3%	0.4	0.4	0.4	Climate Neutral	

# GHG impact: Residential heating

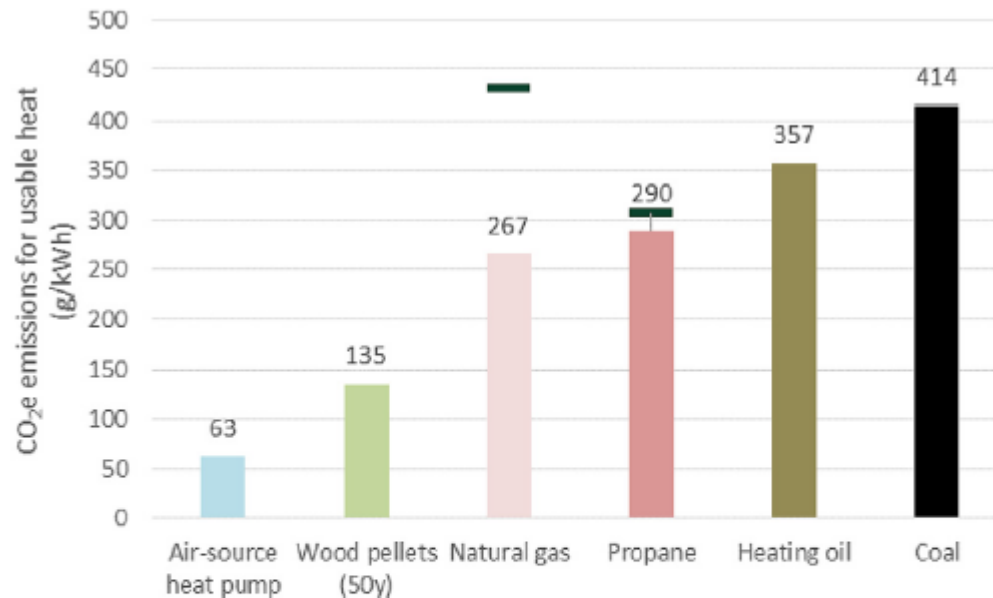


Fig. 3. Net GHG emissions for residential heat from heat of pellets vs. other heating alternatives in the Northern Forest for pellet Scenario 2 'Market Shift' and a feedstock mix of 50% sawmill residue, 50% pulpwood. While this metric suggests a strong impact of heating alternative, wood supply area analysis suggests only a muted impact of heating alternative on GHG emissions. Black bars for natural gas and propane present potential net GHG emissions for these fuels when including methane distribution losses of 2.4% natural gas [28] and 0.24% for propane.

# Key considerations



- GHG results for heat applications are ‘better’ than for electricity-only; CHP can be attractive
- Existing biomass power plants might have ‘paid back’ carbon debt
- Baseline and future scenario assumptions drive results
  - Volume of biomass (does current market support demand?)
  - Supply/Demand study to determine ‘risk’ for additional harvests
- Biomass markets rarely drive harvest decisions but can intensify harvests (Buchholz et al. 2019)
- Forest C stock trajectories are uncertain, some harvest activities can stabilize carbon (e.g., beetle risk; Gunn et al. 2020)



# Questions?

**For Questions:**

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